CLAIMS

What is claimed is:

1. An electrochemical cell comprising:

   a. a first electrode;

   b. a second electrode;

   c. a curable liquid electrolyte disposed between the first and second electrodes, wherein the curable liquid electrolyte comprises:

      i. a protonic polymer having an polymeric backbone with side chains containing acidic groups for conducting protons in an electrochemical cell;

      ii. a first vinyl monomer comprising a –COOH- group; and

      iii. a cross linking agent comprising a second vinyl monomer.

2. The electrochemical cell of claim 1, wherein the protonic polymer comprises sulfonic acid, carboxylic acid, phosphoric acid or combinations thereof.

3. The electrochemical cell of claim 1, wherein the first vinyl monomer is a vinyl phosphoric acid.

4. The electrochemical cell of claim 1 wherein the second vinyl monomer comprises di-vinyl sulphone.

5. The electrochemical cell of claim 1, wherein the curable liquid electrolyte further comprises a solvent.

6. The electrochemical cell of claim 5, wherein the solvent is selected from the group consisting of water, di-methyl acetamide, and combinations thereof.

7. The electrochemical cell of claim 1, wherein the curable liquid electrolyte further comprises a photo-initiator.

8. The electrochemical cell of claim 1, wherein the protonic polymer is sulphonated polyether ether ketone.

9. The electrochemical cell of claim 1, wherein the curable liquid electrolyte further comprises an elasticizing agent.

10. The electrochemical cell of claim 9, wherein the elasticizing agent is acrylonitirle.

11. The electrochemical cell of claim 1, further comprising: a first spacer connected to the first electrode and the second electrode; and a second spacer connected to the first electrode and the second electrode, wherein the curable liquid electrolyte is disposed between the first and second spacers.

12. The electrochemical cell of claim 1, further comprising: a spacer having an injection port disposed between the first electrode and second electrode forming a cavity wherein the curable liquid electrolyte is disposed in the cavity.

13. The electrochemical cell of claim 1, further comprising:

a. a porous substrate;

b. at least one channel disposed in the porous substrate having a first channel wall and second channel wall; and

c. wherein the first electrode is disposed in the first channel and the second electrode is disposed in the second channel wall, and the curable liquid electrolyte is disposed in the channel.

14. The electrochemical cell of claim 1, wherein the substrate is a porous media.

15. The electrochemical cell of claim 1, wherein the substrate comprises a carbon filled epoxy, a carbon filled polymer, a magnelli phase titanium oxide or combinations thereof.

16. The electrochemical cell of claim 13, wherein the substrate comprises a foam, a monolith of porous material, an aero gel, a mat, a felt, paper, mesh, laminates thereof, composites thereof or combinations thereof.

17. The electrochemical cell of claim 13, further comprising:

a. a base comprising at least one distribution plenum for transporting curable liquid electrolyte;

b. at least one fluid port in fluid communication with the channel; and

c. at least one master port for receiving curable liquid electrolyte into the base.

18. The electrochemical cell of claim 17, further comprising a cap disposed over the first electrode to seal the electrode.

19. A method for making an electrochemical cell comprising:

a. forming a curable liquid electrolyte comprising:

b. mixing a first vinyl monomer with a cross linking agent comprising a second vinyl monomer to form a mixture;

c. dissolving a protonic polymer having an polymeric backbone with side chains containing acidic groups into the mixture to form a curable liquid electrolyte solution;

d. disposing the curable liquid electrolyte solution on first and second electrodes to form a precursor; and

e. treating the precursor using a procedure selected from the group consisting of electron bombardment, electron beam treatment, thermal curing, photo-curing to cure the curable liquid electrolyte into a material, wherein at least a portion of the material is solid, thereby forming an electrochemical cell.

20. The method of claim 19, further comprising of adding a solvent to the curable liquid electrolyte solution to reduce viscosity.

21. The method of claim 20, wherein the solvent is selected from the group consisting of water, n-dimethyl acetamide, and combinations thereof.

22. The method of claim 19, further comprising of adding an elasticizing agent to the curable electrolyte solution to reduce brittleness.

23. The method of claim 22, wherein the elasticizing agent is acrylonitirle.

24. The method of claim 19, wherein the curable electrolyte solution is deposited on the first electrode using a flat blade to form a deposited electrolyte layer and then the second electrode is deposited onto the deposited electrolyte layer forming the precursor.

25. The method of claim 19, further comprising using a spacer having an injection port between the first and second electrodes forming a cavity wherein the curable liquid electrolyte is disposed in the cavity.

26. The method of claim 25, wherein the curable liquid electrolyte is disposed in the cavity by pouring the electrolyte into the cavity, pumping the curable liquid electrolyte into the cavity, and injecting the electrolyte into the cavity.

27. The method of claim 19, further comprising:

a. a porous substrate;

b. at least one channel disposed in the porous substrate having a first channel wall and second channel wall; and

c. wherein the first electrode is disposed in the first channel wall, the second electrode is disposed in the second channel wall, and the curable liquid electrolyte is disposed in the channel.

28. The method of claim 19, further comprising:

a. a base comprising at least one distribution plenum for transporting curable liquid electrolyte;

b. at least one fluid port in fluid communication with the channel; and

c. at least one master port and inserting curable liquid electrolyte into the distribution plenum through the at least one master port and then flowing the curable liquid electrolyte through the fluid port into the channel.